UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

Decision Rationale
Total Maximum Daily Load
Phosphorus and Sediment
South Branch Codorus Creek Watershed
York County, Pennsylvania

_____
Jon M. Capacasa, Director
Water Protection Division

Date: _____

Decision Rationale
Total Maximum Daily Load
Phosphorus and Sediments
South Branch Codorus Creek Watershed
York County, Pennsylvania

I. Introduction

This document will set forth the Environmental Protection Agency's (EPA) rationale for approving the Total Maximum Daily Load (TMDL) for nutrients (phosphorus) and sediment in the South Branch Codorus Creek Watershed in York County, Pennsylvania. The document was submitted by the Pennsylvania Department of Environmental Protection (PADEP) for final Agency review by letter dated July 10, 2003, and received by EPA on July 15, 2003. Our rationale is based on the TMDL document and information contained in Appendices to the document to determine if the TMDL meets the following eight regulatory conditions pursuant to 40 CFR §130.

1. The TMDLs are designed to implement applicable water quality standards.
2. The TMDLs include a total allowable load as well as individual waste load allocations (WLA) and load allocations (LA).
3. The TMDLs consider the impacts of background pollutant contributions.
4. The TMDLs consider critical environmental conditions.
5. The TMDLs consider seasonal environmental variations.
6. e TMDL includes a margin of safety (MOS).
7. There is reasonable assurance that the TMDLs can be met.
8. The TMDLs have been subject to public participation.

II. Summary

The South Branch Codorus Creek Watershed encompasses approximately 72 square miles. Landuse in the watershed is largely dominated by agriculture, with other areas being mostly forested. A very small percentage of the landuse comprises developed areas, which consists mostly of low intensity residential and some commercial land. The protected use of the watershed is aquatic life, as the main stem of South Branch Codorus Creek and its tributaries are designated as Warm Water Fishes (WWF) as listed under 25 PA Code Chapter 93, Section 93.9f.

PADEP identified five miles of the main stem of South Branch Codorus Creek on Pennsylvania's 1996 Clean Water Act (CWA) Section 303(d) list of water quality impaired waters as being impaired by nutrients and suspended solids from agriculture sources. For Pennsylvania's 1998 Section 303(d) list, the Department increased the miles impaired to 17.60 miles, as there existed stream bank erosion as evidenced by visible substrate and heavy siltation. In 1999, assessments were conducted on selected segments of South Branch Codorus

Creek as part of PADEP's ongoing Unassessed Waters Program, which included chemical and biological sampling. Additional sampling resulted in designated use impairments being identified for tributaries to South Branch Codorus Creek throughout the watershed. These additional impairment causes were listed on Pennsylvania's 2002 Section 303(d) list, and they are predominately attributed to siltation and emanating from agricultural activities in the watershed.

Note that this TMDL does not address some of the listings added onto the 2002 Section 303(d) list. Streams and the impairments addressed by the TMDLs for the South Branch Codorus Creek Watershed are listed in Table 1. Those impairments not addressed in this TMDL are to remain on the Pennsylvania's CWA Section 303(d) list until they are addressed by a separate TMDL.

TABLE 1. INDICATION OF HOW WATERS FOR WHICH TMDLS WERE DEVELOPED IN THE SOUTH BRANCH CODORUS CREEK WATERSHED ARE REPRESENTED ON THE 1996, 1998 AND 2002 303(D) LISTS

Stream Name (Stream Code)	Segment ID	Miles	Year of 303(d) List	Source	Cause
South Branch Codorus Creek (8093)	--	5.0	1996	Agriculture	Suspended Solids Nutrients
South Branch Codorus Creek (8093)	1275	17.69	1998	Agriculture	Suspended Solids Nutrients
South Branch Codorus Creek (8093)	1275	16.4	2002	Agriculture	Suspended Solids Nutrients
South Branch Codorus Creek (8093)	19990630-1201-MSE	1.6	2002	Municipal Point Source	Nutrients
Buffalo Valley Hollow (8156, 8157)	19990923-1026-MSE	4.2	2002	Agriculture	Siltation
Centerville Creek (8172 thru 8178)	19990719-0944-MSE	8.1	2002	Agriculture	Siltation
Foust Creek (8179)	19990811-0921-MSE	2.2	2002	Agriculture	Siltation
Krebs Valley Creek (8164)	19990811-1117-MSE	4.2	2002	Agriculture	Siltation
Pierceville Run (8166 thru 8171)	19990716-1109-MSE	9.8	2002	Agriculture	Siltation
South Branch Codorus Creek (8190, 8191)	19990630-1054-MSE	2.7	2002	Urban Runoff	Siltation

Section 303(d) of the CWA and its implementing regulations require a TMDL to be developed for those water bodies identified as impaired by the state where technology-based and other controls did not provide for attainment of water quality standards. These TMDLs were developed to address the impairments caused by excess sediment and nutrients in waters of the South Branch Codorus Creek Watershed.

According to Federal regulations at 40 CFR §130.2(g), LAs are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading. Table 2 summarizes the elements of the TMDLs for phosphorus and sediment developed by PADEP. Despite the fact that EPA believes that annual loads are an appropriate measure for these TMDLs, for the sake of consistency, we are breaking the annual TMDL loads into daily loads.

Note that the TMDLs were developed for two subbasins within the South Branch Codorus Creek Watershed, as described in the TMDL Report.

TABLE 2. SUMMARY OF TMDLS FOR THE SOUTH BRANCH CODORUS CREEK WATERSHED

Water-shed	Pollutant	LA	WLA	MOS	TMDL		Existing Load	% Reduction
		(lbs/yr)	(lbs/yr)	(lbs/yr)	(lbs/yr)	(lbs/d)	(lbs/yr)	
S Br Codorus Creek - Subbasin 1	Phosphorus	11,080.30	3650.00	1636.70	16,367.00	44.8	33,852.94	52%
	Sediment	12,396,114.00	0.00	1,377,346.00	13,773,460.00	37,735.5	29,141,794.00	53%
S Br Codorus Creek - Subbasin 2	Phosphorus	5290.92	6853.33	1349.36	13,493.61	37.0	24,269.00	44%
	Sediment	10,219,852.62	0.00	1,135,539.18	11,355,391.80	31,110.7	17,753,092.40	36%

The TMDL is a written plan and analysis established to ensure that a waterbody will attain and maintain water quality standards. The TMDL is a scientifically-based strategy which considers current and foreseeable conditions, the best available data, and accounts for uncertainty with the inclusion of a Margin of Safety (MOS) value. Conditions, available data, and the understanding of the natural processes can change more than anticipated by the MOS. The option is always available to refine the TMDL for resubmittal to EPA for approval. The Unassessed Waters Protocol, a method of conducting biological assessments of Pennsylvania's waters, was developed in 1996 and implementation began in 1997. PADEP's goal is to achieve a comprehensive, statewide assessment of surface waters in Pennsylvania. After completion of the initial assessments, the long-range goal is to reassess all waters on a five-year cycle. Therefore, while the TMDL should not be modified at the expense of achieving water quality standards expeditiously, the TMDL may be modified when warranted.

III. Discussion of Regulatory Conditions

EPA finds that Pennsylvania has provided sufficient information to meet all of the eight basic requirements for establishing phosphorus and sediment TMDLs for the main stem and tributaries in the South Branch Codorus Creek basin. EPA therefore approves the TMDLs and information contained in the TMDL Report and Appendices for phosphorus and sediment in the South Branch Codorus Creek Watershed. EPA's rationale for approval is set forth according to the regulatory requirements listed below.

1. TMDLs are designed to implement the applicable water quality standards.

Water Quality Standards consist of three components: 1) designated and existing uses; 2) narrative and/or numerical water quality criteria necessary to support those uses; 3) and an antidegradation statement. The designated use of the entire South Branch Codorus Creek basin is Warm Water Fishes (WWF). Pennsylvania does not currently have numeric water quality criteria for nutrients (nitrogen or phosphorus) or sediments. Therefore, Pennsylvania utilized its narrative water quality criteria, which states "water may not contain substances attributable to point or nonpoint source waste discharges in concentrations or amounts sufficient to be inimical or harmful to the water uses to be protected or to human, animal, plant, or aquatic life",[1] to establish an endpoint for phosphorus and sediment such that the designated uses of the South Branch Codorus Creek Watershed are attained and maintained.

In order to numerically express this endpoint consistent with the general water quality criteria, PADEP uses a Reference Watershed approach in combination with the AVGWLF[2] watershed loading model. The reference watershed is representative of the conditions required for the impaired watershed to meet its designated uses. This representative condition is analyzed to determine an appropriate level of nutrient and sediment loading to the waterbody. The Reference Watershed approach consists of comparing the biologically-impaired watershed with a reference watershed that is meeting its designated uses for aquatic life to determine an appropriate level of nutrient and sediment loading to the waterbody. This approach is based on comparing the impaired watershed to one with similar designated uses, geology, landuses, physiographic province, land area, soils, and meteorological patterns. The AVGWLF model provides a powerful and accurate means of estimating the dissolved and total nutrient loadings to a stream from complex watersheds with added GIS capabilities. The model provides monthly stream flow, soil erosion, and sediment yield values and includes both surface runoff and groundwater sources as well as nutrient loads from point sources and onsite wastewater disposal (septic) systems.[3] Calibration for this model is not required; however, it has been applied and

---

[1] Pennsylvania Code, Title 25., Environmental Protection, Chapter 93. Water Quality Standards, Section 93.6(a).

[2] Arcview Generalized Watershed Loading Function model, the Environmental Resources Research Institute of Pennsylvania State University's Arcview based version of the GWLF model developed by Cornell.

[3] Haith, D.A., R. Mandel and R.S. Wu, Generalized Watershed Loading Functions, Version 2.0, Cornell University, Dec. 15, 1992.

validated to an 85,000 hectare watershed in upstate New York. The rationale of this method is that achieving nutrient and sediment loadings in the impaired watershed similar to those loadings of the reference watershed will ensure that the impaired watershed will attain and maintain its designated uses and general water quality criteria.

The North Branch Muddy Creek Watershed is used as the reference watershed for comparison with the South Branch Codorus Creek Watershed to develop the sediment and phosphorus TMDLs. Table 3 below compares these watersheds by physical properties and other factors. EPA finds the use of the North Branch Muddy Creek Watershed as a reference watershed to be reasonable for these TMDLs.

TABLE 3. COMPARISON BETWEEN SOUTH BRANCH CODORUS CREEK WATERSHED AND REFERENCE WATERSHED

Attribute	South Branch Codorus	Reference
Physiographic Province	Piedmont (100%)	Piedmont (100%)
Area (mi^2)	30 (Subbasin1); 32 (Subbasin 2)	43
Predominant Landuse	Agriculture (70%)	Agriculture (63%)
Predominant Geology	Igneous/Metamorphic (94%)	Igneous/Metamorphic (100%)
20-Yr Average Rainfall (in)	39.5	38.5
20-Yr Average Runoff (in)	0.54	1.2

Using the continuous simulation AVGWLF model, PADEP modeled the nutrient and sediment loads originating from nonpoint sources in the reference watershed. As previously mentioned, AVGWLF has the ability to estimate dissolved and total monthly nutrient loads to streams from watersheds including surface runoff, groundwater sources, point sources, septic systems, monthly streamflow, soil erosion, and sediment yield values. In order to make these estimates, AVGWLF requires daily precipitation and temperature data, runoff sources and transport, and chemical parameters. The AVGWLF model is a combined distributed/lumped parameter watershed model. In terms of surface loading, this means that the model allows the user to distribute multiple landuse/cover scenarios in the watershed; however, the loads originating from the watershed are lumped and spatial routing of nutrient and sediment loads is not available. In terms of subsurface loading, the load contributions from subsurface areas are not distinct and are considered lumped using a water balance approach. The AVGWLF model relies on the Soil Conservation Service Curve Number (SCS-CN) to estimate surface runoff and

the Universal Soil Loss Equation (USLE) to estimate erosion and sediment yield. Monthly estimates of nutrient and sediment loadings, applicable to each watershed, are generated by using watershed-specific local daily weather inputs and USLE factors.[4] The following average existing load values for sediment, illustrated in Table 4, were determined for the North Branch Muddy Creek reference watershed and the South Branch Codorus Creek Watershed using watershed-specific data.

TABLE 4. EXISTING SEDIMENT LOADING VALUES FOR THE REFERENCE WATERSHED AND THE SOUTH BRANCH CODORUS CREEK WATERSHED.

	Area (Acres)	Mean Annual Sediment Load (lbs/yr)	Unit Area Sediment Loading Rate (lbs/acre/yr)
North Branch Muddy Creek Watershed (Ref Watershed)	27,853.70	15,237,405.20	547.05
S Br Codorus Creek Subbasin 1	25,180.00	29,141,794.00	1,157.34
S Br Codorus Creek Subbasin 2	20,759.40	17,753,092.40	855.18

Although both nutrients (phosphorus and nitrogen) are listed as the causes of impairment and are subsequently modeled, only a TMDL for phosphorus is being established to help restore the designated uses of the South Branch Codorus Creek Watershed. This is due to PADEP's finding that phosphorus is the limiting nutrient in all waters of the South Branch Codorus Creek basin. Phosphorus is often the major nutrient in shortest supply and is frequently a prime determinant of the total biomass.[5] It is also the most effectively controlled using existing engineering technology and landuse management.[6] EPA finds this to be a reasonable determination.

Table 5 illustrates the average existing load values for phosphorus as determined for the reference watershed and the South Branch Codorus Creek Watershed using watershed-specific data.

TABLE 5. EXISTING PHOSPHORUS LOAD VALUES FOR THE REFERENCE WATERSHED AND THE SOUTH BRANCH CODORUS CREEK WATERSHED

	Area (Acres)	Mean Annual Total Phosphorus Load (lbs/year)	Unit Area P Loading Rate (lbs/acre/yr)

[4] Local daily weather inputs include temperature and precipitation. The USLE factors are KLSCP; K=changes in soil loss erosion, LS=length slope factor, C=vegetation cover factor, P=conservation practices factor.

[5] U.S. EPA. 1980. Modeling Phosphorus Loading and Lake Response under Uncertainty: A Manual and Compilation of Export Coefficients. EPA 440/5-80-011.

[6] Ibid.

North Branch Muddy Creek Watershed (Ref Watershed)	27,853.70	18,144.50	0.65
S Br Codorus Creek Subbasin 1	25,180.00	25,180.00	1.34
S Br Codorus Creek Subbasin 2	20,759.40	24,269.89	1.17

The final step in the process is to determine the appropriate pollutant loading for each water. For the South Branch Codorus Creek Watershed, the values generated for sediment and phosphorus loading were based on those found in the reference North Branch Muddy Creek Watershed. In the process of determining the total phosphorus and sediment loadings in the reference watershed, a unit area loading coefficient for the parameter of concern was calculated. Those aerial loading coefficients were applied to each of the South Branch Codorus Creek subbasins to determine the allowable (TMDL) sediment and phosphorus loadings. EPA finds this application reasonable to implement the applicable water quality standards.

Table 6 illustrates the sediment TMDL calculations. The target TMDL value for sediment is determined by multiplying the unit area loading value of the reference watershed by the total area in acreage of each impaired watershed subbasin.

TABLE 6. SEDIMENT TMDL CALCULATIONS.

Watershed	Unit area loading rate in Reference N Br Muddy Creek Watershed (lbs/ac/yr)	Total watershed area in Impaired S Br Codorus Creek (acres)	TMDL value for sediment (lbs/yr)
S Br Codorus Creek - Subbasin 1	25,180.00	547.00	13,773,460.00
S Br Codorus Creek - Subbasin 2	**20,759.00**	547.00	11,355,391.00

Table 7 illustrates the phosphorus TMDL calculations. The target TMDL value for phosphorus is determined by multiplying the unit area loading value of the reference watershed by the total area in acreage of each impaired watershed subbasin.

TABLE 7. PHOSPHORUS TMDL CALCULATIONS.

Watershed	Unit area loading rate in Reference N Br Muddy Creek Watershed (lbs/ac/yr)	Total watershed area in Impaired S Br Codorus Creek (acres)	TMDL value for phosphorus (lbs/yr)

S Br Codorus Creek - Subbasin 1	25,180.00	0.65	16,367.00
S Br Codours Creek - Subbasin 2	20,759.00	0.65	13,493.61

2. The TMDLs include a total allowable load as well as individual WLAs and LAs.

Tables 2, 6, and 7 indicate the total allowable loads for phosphorus and sediment as determined using the Reference Watershed approach and the AVGWLF model.

A. Wasteload Allocations (WLAs)

There are two NPDES permitted wastewater plants that discharge nutrients into South Branch Codorus Creek - one in each subbasin. Glen Rock (NPDES #PA0020818) is located in Subbasin 1, and New Freedom (NPDES #PA0043257) is located in Subbasin 2. The phosphorus TMDL includes a WLA of 3,650 lbs/yr and 6,853 lbs/yr for Glen Rock and New Freedom, respectively. Neither facility is a point source of sediment and, therefore, were only assigned a WLA for phosphorus.

There are not any Municipal Separate Storm Sewers (MS4s) within the South Branch Corodus Creek Watershed, according to PADEP's identification of MS4s within urbanized areas. Therefore, the TMDL assigns two WLAs, one for each point source identified above.

B. Load Allocations (LAs)

The TMDLs include LAs for nonpoint sources. According to Federal regulations, 40 CFR §130.2(g), LAs are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading. The AVGWLF process enables the LA to be distributed to sources based on landuse type.

The process of allocating phosphorus and sediment loads to distinct landuses in the South Branch Codorus Creek subbasins begins by subtracting 10% from the TMDL value for the MOS. For example, the allocable load for sediment in the South Branch Codorus Creek Subbasin 1 of 13,773,460 lbs/year is reduced by 1,377,346 lbs/year to 503,362 lbs/year (13,773,460 lbs/year x 0.1 = 1,377,346 lbs/year). The allocable load for phosphorus is also reduced by 10% to allow for a MOS. See below for further discussion on the application of a MOS in TMDLs.

As discussed earlier, LAs for phosphorus and sediment were determined by multiplying the unit area loading rate for phosphorus of the reference North Branch Muddy Creek Watershed by the total area in each of the South Branch Codorus Creek subbasins. To determine the distribution of the sediment and/or phosphorus LA between contributing land-based sources,

PADEP uses a method called the Equal Marginal Percent Reduction (EMPR).[7] This method equitably assigns the largest contributing source, the greater reduction requirements. Table 8 shows the LAs of sediment in Subbasin 1 of the South Branch Codorus Creek Watershed. The table shows the overall average reductions in sediment for each landuse and is useful in demonstrating the EMPR method employed by PADEP to distribute the allocable loads of phosphorus and sediment in these TMDLs.

TABLE 8. SUMMARY OF LAS FOR SEDIMENT IN THE SOUTH BRANCH CODORUS CREEK - SUBBASIN 1

Landuse		Sediment (lbs/yr)						
		Acres	Existing Load	Baseline Reduction	Baseline Load	EMPR Reduction	TMDL LA	% Reduction
Hay/Pasture		5839	849,600	0	849,600	74,680	774,920	9%
Cropland		12,286	27,868,000	15,559,486	12,308,514	1,081,927	11,226,587	60%
Developed	Unpaved Roads	49	38,000	0	38,000	3481	36,119	9%
	Low Intensity Develop-ment	84	1600	0	1600			
	High Intensity Development	7	0	0	0	0	0	0
Streambank			296,994.00	0	296,994	26,106	270,888	9%
Total			**290,054,194**	**15,559,486**	**13,494,708**	**1,186,194**	**12,308,514**	**96%**

The total allocable load of sediment in Subbasin 1 is 12,396,114 lbs/year after subtracting the MOS. The EMPR method is then used to distribute the remaining sediment load and works in the following manner. PADEP allocated certain landuse loadings similar to their existing loads, and in the South Branch Codorus Creek watershed, those landuses include various types of forested areas. Reasons that the loads for these landuse types remain constant include an extremely limited ability to affect the sediment loading processes or insufficient reasonable assurance to make substantial reductions. This is appropriate because sediment loading from intact forest lands represents the natural condition that would be expected to exist. Therefore, the allocable load in Subbasin 1 for sediment of 12,396,114 lbs/yr is further reduced by 87,600 lbs/yr to 12,308,514 lbs/yr. The value of 87,600 lbs/yr is the sum of the sediment load in Subbasin 1 from coniferous forest (1200 lbs/yr), mixed forest (1800 lbs/yr), and deciduous forest (84,600 lbs/yr). The remaining "active landuse" current loads (hay/pasture, unpaved roads and low intensity development represented by 'developed', and streambank) are then compared with the remaining allocable load of 12,308,514 lbs/yr to determine if any one contributor would

[7] Pennsylvania Department of Environmental Protection. June 1986. Implementation Guidance for the Water Quality Analysis Model 6.3. Document 391-2000-007.

exceed this load by itself. If the remaining allocable load is exceeded by any landuse, it will be reduced to the allocable load value of 12,308,514 lbs/yr. If the allocable load is not exceeded, the existing load becomes the baseline load. In Table 8, only the 'cropland' landuse with an existing load of 27,868,000 lbs/yr exceeds this value. Therefore, in Subbasin 1, 'cropland' is reduced to 12,308,514 lbs/yr, which becomes the baseline load. The actual value of the reduction is represented in the 'Baseline Reduction' column of Table 8. The baseline loads are then summed to determine the equal percent reduction that must occur in the "active landuses" to achieve the allocable load value of to 12,308,514 lbs/yr. The total baseline load is 13,494,708 lbs/yr, which must be reduced approximately 9 percent to equal 12,308,514 lbs/yr. This reduction can be seen in the 'EMPR Reduction' column of Table 8, which is then subtracted from the baseline load value to determine the TMDL LA value for each landuse.

This same method was used to determine the phosphorus reductions in each of the subwatersheds. EPA finds that PADEP appropriately applied the EMPR method for phosphorus and sediment in the South Branch Codorus Creek watershed TMDLs. According to Federal regulations at 40 CFR §130.2(g), LAs are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading. While it is not necessary to specifically approve an allocation method, EPA believes that the EMPR method used by PADEP is acceptable because it supports three main objectives: 1) to assure compliance with the applicable water quality standard; 2) to minimize the overall cost of compliance and; 3) to provide maximum equity among competing discharges.

3. The TMDLs consider the impacts of background pollutant contributions.

The state has included natural background as a component of the LAs, as required by 40 CFR §130.2(g). There are two separate considerations of background pollutants within the context of these TMDLs. First, there is the inherent assumption of the Reference Watershed approach that because of the similarities between the reference and impaired watershed, the background pollutant contributions will be similar. Therefore, the background pollutant contributions will be considered when determining the loads for the impaired watershed which are consistent with the loads from the reference watershed. Secondly, the AVGWLF model implicitly considers background pollutant contributions through the groundwater component of the model process.

4. The TMDLs consider critical environmental conditions.

EPA regulations at 40 CFR §130.7(c)(1) require TMDLs to take into account critical conditions for streamflow, loading, and water quality parameters. The intent of this requirement is to ensure that the water quality of the South Branch Codorus Creek Watershed is protected during times when it is most vulnerable.

Critical conditions are important because they describe the factors that combine to cause a violation of water quality standards and will help in identifying the actions that may have to be undertaken to meet water quality standards.[8] In specifying critical conditions in the waterbody, an attempt is made to use a reasonable "worst case" scenario condition. Critical conditions are the combination of environmental factors (e.g., flow, temperature) that results in attaining and maintaining the water quality criterion and has an acceptably low frequency of occurrence. For example, stream analysis often uses a low flow (7Q10) design condition as critical because the ability of the waterbody to assimilate pollutants without exhibiting adverse impacts is at a minimum.

Within the context of the Reference Watershed approach, the assumption is that the reference watershed is achieving its designated use even during critical environmental conditions. Thus, achieving sediment and/or phosphorus loadings in the impaired watershed consistent with that of the reference watershed will effectively consider critical conditions. To account for different flow conditions, the AVGWLF model uses daily average temperature, daily time step and total precipitation values for each year simulated. PADEP modeled each watershed for a period of up to 20 years to develop the existing loading values for each watershed. The length of the model time period will also effectively consider critical environmental conditions. EPA finds that Pennsylvania adequately considered critical conditions in the TMDL analysis of the South Branch Codorus Creek subbasins.

5. The TMDLs consider seasonal environmental variations.

Seasonal variations involve changes in streamflow as a result of hydrologic and climatological patterns. In the continental United States, seasonally high flow normally occurs during the colder period of winter and in early spring from snowmelt and spring rain, while seasonally low flow typically occurs during the warmer summer and early fall drought periods.[9] The model considers seasonal changes requiring specifications of the growing season, hours of daylight for each month, the months in which manure is applied to the land and by using daily time steps for weather data and water balance calculations. EPA finds that both the AVGWLF model and the assumptions of the Reference Watershed approach effectively consider seasonal environmental variations.

6. The TMDLs include a MOS.

This requirement is intended to add a level of safety to the modeling process to account for any uncertainty. A MOS may be implicit, built into the modeling process, or explicit, taken as a percentage of the WLA, LA, or TMDL.

---

[8] EPA Memorandum regarding EPA Actions to Support High Quality TMDLS from Robert H. Wayland III, Director, Office of Wetlands, Oceans, and Watersheds to the Regional Water Management Division Directors, August 9, 1999.

[9] U.S. EPA. 1997. Technical Guidance Manual for Developing Total Maximum Daily Loads, Book 2, Part 1, Section 2.3.3. EPA 823-B-97-002.

PADEP reserves 10% of the TMDL value for both phosphorus and sediments as the MOS. This accounts for uncertainty in the data and computational methodology used in the analysis. Table 2 indicates the actual value of the MOS for each TMDL. EPA finds this explicit MOS acceptable.

7. There is reasonable assurance that the TMDLs can be met.

The proposed reductions in phosphorus and sediment loadings mostly come from agricultural areas. PADEP believes that the implementation of BMPs throughout the South Branch Codorus Creek Watershed will allow the TMDL to be achieved. There is one point source located within Subbasin 1 of the watershed in Glen Rock (NPDES #PA0020818), and one point source located within Subbasin 2 of the watershed in New Freedom (NPDES #PA0043257). Both wastewater treatment plants have been assigned WLAs for phosphorus loadings, and these WLAs are to be reflected in their NPDES permits upon reissuance.

The pollutant reductions in the TMDLs are allocated predominantly to agricultural activities in the watershed. Stream restoration efforts and implementation of Best Management Practices (BMPs) in the affected agricultural areas should achieve the loading reduction goals established in the TMDLs. Substantial reductions in the amount of sediment reaching the streams can be made through, among other BMPs, the installation of stream bank fencing, riparian buffer zones, strip cropping, contour plowing, conservation crop rotation, and heavy use area protection. These BMPs range in efficiency from 20% to 70% for sediment reduction. Implementation of BMPs aimed at sediment reduction will also assist in the reduction of phosphorus.

There are currently several restoration initiatives underway in the South Branch Codorus Creek Watershed to control nonpoint source runoff from agricultural lands. Coordination for many of these initiatives has been supported by the York County Conservation District. Since 2000, several thousand streambanks have been restored; other specific BMPs include manure storage systems, treatment of runoff from animal confinement and barnyard areas, and stormwater controls. The York Chapter of the Isaac Walton League has been an active contributor to many of the restoration efforts within the South Branch Codorus Watershed, and many of these efforts have been aimed at reducing the nonpoint source pollution and sediment loads from eroded streambanks and overland flow. Some stream restoration projects have also attempted to mitigate increased stream velocities due to an increase in impervious surfaces or urban runoff. Additionally, the U. S. Corp of Engineers, and several project partners, are conducting an assessment within the watershed, and a component of the study is focused on nonpoint agricultural runoff.

Funding assistance for the types of projects described above include Pennsylvania's Growing Greener funding which has provided more than $65 million to environmental initiatives through out the Commonwealth. Additionally, annual Section 319 grant funding, supported by

the Unified Watershed Assessment and the Watershed Restoration Action Strategies, is designed to focus resources toward the implementation of BMPs for nonpoint source pollutants. To date, well over $500,000 has been spent to implement BMPs and stabilize streambanks, and several more projects have been approved by the Growing Greener and 319 Program grants. Pennsylvania has staffed watershed coordinators in each Regional office who are available to provide grant application assistance to stakeholders as well as technical assistance on the installation of management practices.

8. The TMDLs have been subject to public participation.

Pennsylvania published a notice of availability for the South Branch Codorus Creek Watershed TMDLs for public review and comment in the *Pennsylvania Bulletin* December 14, 2002. A public meeting was held on January 29, 2003 in the Nature Center at Nixon County Park in York, Pennsylvania.

A 60-day comment period was provided for the submittal of comments. Comments were received from various parties and individuals, including the New Freedom Borough and EPA. (Note that EPA's comments were not included, and others that commented were not identified, in Appendix G, the Comments and Response Document, of the TMDL Report.) EPA finds that PADEP has conducted an adequate public participation.

Although not specifically stated in the TMDL Report, PADEP routinely posts the approved TMDL report their web site: www.dep.state.pa.us./watermanagement_apps/tmdl/